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REQUIREMENTS DOCUMENT

BATTERY POWER SUPPLY

MINUTEMAN GUIDANCE AND CONTROL

SE-13G BATTERY

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(SOURCE CONTROL NUMBER 7327690-10)

MINUTEMAN GUIDANCE AND CONTROL

SE-13G BATTERY

1. SCOPE - This requirements document specifies one type of equipment designated as the Battery Power Supply PP-3249/DJW-15, defined on Source Control Drawing 7327690, used to provide electrical power to certain components of a missile system. The battery shall be activated by a gas generating device which is to be built into the unit. The battery shall be supplied with a shorting device.

2. APPLICABLE DOCUMENTS

2.1 Government Documents - The following Government documents form a part of this specification to the extent specified herein. Specific revisions to these documents may be delineated by the applicable purchasing document.

SPECIFICATIONS

Military

MIL-D-3464	Desiccant, Activated, Bagged, Packaging Use and Static Dehumidification
MIL-D-6054	Drum, Metal, Shipping and Storage
MIL-G-45204	Gold Plating, Electrodeposited
MIL-N-18307	Nomenclature and Nameplates for Aeronautical Electronic and Associated Equipment
MIL-W-6858	Welding, Aluminum, Magnesium, Non-Hardening Steels or Alloys, and Titanium, Spot, Seam and Stitch
S-1338-127A	System Specification for WS-1338 Minuteman III Weapon System (Includes SCN 1 & 2)
MIL-W-8611	Welding, Metal Arc and Gas, Steels, and Corrosion and Heat Resistant Alloys, Process for

MIL 454 Rev G requirement 5

STANDARDS

Military

MS-26507	Indicator, Humidity, Card, Special
MIL-STD-105A	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts

Federal

PPP-B-636	Box, Fiberboard

DRAWING

7327690	Battery Power Supply (Source Control Drawing)

3. REQUIREMENTS

3.1 Design and Construction - The design and construction of the PP-3249/DJW-15 Battery Power Supply shall be in accordance with 7327690.

3.1.1 Positive Plate Material - The positive plate shall be formed from a sintered matrix of silver powder with the following characteristics:

Minimum Silver Content			99.9%
Spectrographic Chemical Analysis			(Maximum)
Copper	0.05%	Tin	0.003%
Lead	0.003%	Zinc	0.003%
Bismuth	0.001%	Gold	0.005%
Iron	0.006%	Palladium	0.005%
Manganese	0.003%	Selenium	0.001%
Nickel	0.002%	Tellurium	0.002%
Magnesium	0.002%	Cadmium	0.003%
Silicon	0.005%		

NOTE: Compounds, e.g. silver sulfide, that may be formed as products of contamination shall not exceed 0.1 percent. Moisture content shall not exceed 0.04 percent.

Physical Composition:

The fineness shall be 90 - 100 percent through a 325 mesh sieve.

The apparent density shall be 30 - 35 grams/cubic inch.

The average particle diameter shall be 6 - 9 microns as determined by the Fisher Sub Sieve Sizer.

3.1.2 Electrical Terminals - All terminals and external wiring hardware, including the shorting device, shall be gold plated per MIL-G-45204.

3.1.3 Configuration - The battery configuration and critical dimensions shall be per 7327690. One each of the plain washer, internal lock washer and plain nut (Reference Figures 1 and 2) shall be furnished by the supplier for each terminal stud indicated on 7327690. Decals shall be per MIL-N-18307 with sizing and nomenclature per Figure 3.

3.1.4 Construction - The battery shall be of the dry-charged type with an electrolyte reservoir and an activator assembly. The battery canister shall be hermetically sealed. Before the final hermetic seal is completed, the canister shall be evacuated to an absolute pressure of 100 microns of Mercury and back filled with 100 percent Grade A Helium to a pressure of 15 (+1, -0) psia.

3.1.5 Venting Provision - The battery canister may contain provision for breaking of the hermetic seal to reduce expansion after activation provided that a tube may be attached to the battery vent indicated on 7327690 such that all vented products may be conducted away.

3.2 Performance

3.2.1 Battery Activation - Electrical power applied between terminals A and B shall cause the battery to be activated. Reference 7327690.

3.2.1.1 Activating Circuit Resistance - The parallel squib resistance as measured between terminals A and B shall be 0.5 (±0.075) ohms.

3.2.1.2 Sure-Fire - A current of 9 (+0, -0.5) amperes applied for 20 milliseconds maximum shall cause battery activation to full power in less than four seconds total lapsed time.

3.2.1.3 No-Fire - An average current of 2.0 (+0.2, -0) amperes applied for a minimum of five minutes shall not activate the battery.

3.2.1.4 Activation Orientation - The battery shall be activated with its +Z axis within ten degrees of vertical as indicated on 7327690. Once activated, the battery shall be capable of operating in any orientation.

3.2.2 Gas Generator Characteristics - The source of activating energy shall be an electrically initiated gas generating squib (gas generator) which shall cause battery activation as specified in 3.2.1. Two completely independent gas generators shall be connected in parallel to terminals A and B (SCD 7327690), either of which will cause complete activation and performance of 3.2.3 should one generator fail to fire.

3.2.2.1 Construction - The generator housing and base plug shall be made from corrosion resistant steel, Type 303. Leadwires supplied to length specified shall be 22AWG stranded, tin or silver plated copper wire insulated with a bonded 105°C rated polyvinyl chloride coating. The base plug seal of the generator shall be capable of withstanding a pressure of 1650 psig minimum without rupturing. The explosive train shall consist of a hermetically sealed

igniter (match), sustainer powder, and solid propellant necessary to produce the performance characteristics of 3.2.2.2.

3.2.2.2 Performance

3.2.2.2.1 Insulation Resistance - With the leadwires shorted together, the insulation resistance between the leadwires and generator housing shall exceed 50 megohms at 500 ±25 vdc.

3.2.2.2.2 Bridgewire Resistance - The resistance of the individual generator bridgewire shall be 0.85 - 1.15 ohms including leadwires specified. Limit test current to ten milliamperes and total test time to five minutes.

3.2.2.2.3 No-Fire Capability - The generator bridgewire shall tolerate a current of 1.00 - 1.02 amperes (one watt) for a minimum period of five minutes without firing.

3.2.2.2.4 Sure-Fire Capability - The generator shall fire when the current through the bridgewire is 3.40 - 3.50 amperes for a period of 15 - 20 milliseconds.

3.2.2.2.5 Peak Pressure - The generator shall develop a peak pressure of 1100 ±400 psig within 2.0 seconds maximum when fired in a standard 135 ±1 CC closed bomb. Monitoring of the pressure-time relationship shall employ equipment with ±2 percent accuracy and shall continue for an elapsed period of at least 2.5 seconds after sure-fire current is applied.

3.2.2.2.6 Displacement Capacity - The amount of water displaced by the generator when fired into a closed water filled chamber with an outlet orifice shall be 1200 cubic centimeters, minimum.

3.2.2.3 Environments - The generator, as a separate component from the battery, shall function as specified in 3.2.2.2 after exposure to the non-operating environments specified for the battery in 3.3.1.

The generator, as an integral component of the battery (installed pair), shall function as specified in 3.2.1 after the battery with generators is exposed to the non-operating environments specified in 3.3.1.

3.2.2.4 Storage Life - In addition to the five year storage life as an integral battery component (see 3.10), the generator shall be capable of storage as a separate component for a minimum period of one year while exposed to the static environments of 3.3.1.

3.2.2.5 Reliability - Reliability shall be a prime consideration in generator design and fabrication. The generator (component level) reliability requirement shall be 0.9995 or greater probability of functioning as required in 3.2.2.2 with 90 percent confidence.

3.2.2.6 Marking - The following information shall be permanently marked on each generator housing:

Manufacturer's name or trademark.
Manufacturer's part number.
Manufacturer's lot number.
Generator serial number.
Capacity of generator (cubic centimeters).

3.2.3 Output Voltage - The activated battery shall be capable of supplying the required voltage, measured between terminals 1 and 2 indicated on 7327690, to the following load profiles:

3.2.3.1 Load Profile I - From four seconds after start of activation until 94 seconds after activation, the battery shall provide 28 (+2, -4) volts (v) direct current (dc) to the load profile in Figure 4.

3.2.3.2 Load Profile II - From four seconds after start of activation until 226 seconds after activation, the battery shall provide 29 (+1.7, -1.0) vdc to the load profile, except at peak demand, indicated in Figure 5.

3.2.3.3 Load Profile III - From four seconds after start of activation until 226 seconds after activation, the battery shall provide 28 (+2, -4) vdc to the load profile indicated in Figure 6.

3.2.3.4 Load Profile IV - From four seconds after start of activation until 226 seconds after activation, the battery shall provide 28 (+2, -4) vdc to the load profile indicated in Figure 7.

3.2.4 Insulation Resistance

3.2.4.1 Battery Terminals - The insulation resistance between the connected terminals and the canister as listed below shall exceed the following minimums with an impressed voltage of 500 (±5 percent) vdc applied for one minute minimum for conditions 'a' and 'b'. For condition 'c', 100 (±10 percent) vdc will be used (terminals reference 7327690).

HUMIDITY TEST	DRY TEST		FROM	TO
10 megohms	50 megohms	a.	Terminals 1 and 2 (interconnected)	Canister and terminals A and B (interconnected)
10 megohms	50 megohms	b.	Terminals A and B (interconnected)	Canister
10 megohms	50 megohms	c.	Terminal 1	Terminal 2

3.2.4.2 Cell Pack - When 100 ±5 vdc is applied to the cell pack terminals, the resistance measured between the terminals shall be more than 50 megohms.

3.2.5 Current Leakage - The leakage current to the canister shall not exceed the following conditions after battery activation:

0 to 226 seconds		226 seconds to 600 seconds
3 micro amperes	< i <	1 ampere

3.2.6 Electrolyte Leakage - The battery shall not discharge electrolyte external to the canister under any conditions of storage, or within 226 seconds after start of activation and discharging to load profile of Figure 4, 5, 6, or 7.

3.2.7 Helium Leak Rate - The helium leak rate from the canister shall be less than 1.0×10^{-5} cubic centimeters (cc) per second at less than 100 microns absolute pressure.

3.2.8 Cell Pack Characteristics - The cell pack shall exhibit an output voltage of 1.21 v to 1.49 v for 110 seconds minimum when discharged to the load profile of Figure 4 and within a starting temperature range of 60°F to 100°F inclusive.

3.2.9 Dielectric Strength - The battery shall withstand 500 (±5 percent) volts root mean square (rms) alternating current (vac) at a frequency of 60 ±1 Hertz (Hz) between connected terminals and the canister (reference 7327690) or between the connected terminals, listed as follows, for a minimum of one minute. There shall be no evidence of electrical breakdown.

	FROM	TO
a.	Terminals 1 and 2 (interconnected)	Canister and Terminals A and B (interconnected)
b.	Terminals A and B (interconnected)	Canister

3.3 Environments

3.3.1 Non-Operating - The following paragraphs define environments occurring separately or in combinations that may be encountered by the battery. The battery shall meet the performance requirements of 3.2, with the exception of 3.2.4.2 and 3.2.8 after being subjected to these environments.

3.3.1.1 Humidity - The battery shall withstand relative humidity up to 100 percent.

3.3.1.2 Altitude - The battery shall withstand pressures ranging from 15.0 to 1.7 pounds per square inch absolute (psia).

3.3.1.3 Temperature - The battery shall withstand surrounding air temperatures ranging from a minimum of -50°F to a maximum of +115°F. The air temperature may change at rates up to 1.8°F per second.

3.3.1.4 Vibration - The battery shall withstand vibrations which can be represented by the following sinusoidal vibrations:

Frequency	Acceleration
(±2% or ±1/2 Hertz (Hz) below 20 Hz)	(±10%)
5-50 Hz	3.5 g* rms (Limited to 0.4 inch double amplitude as per 4.4.3.1.3)

Frequency	Acceleration
50-300 Hz	1.5 g rms

*acceleration due to gravity (g)

3.3.1.5 Shock

3.3.1.5.1 Service - The unpackaged battery shall withstand the following service handling drops, onto a hard surface:

3.3.1.5.1.1 Free Drop - One-inch minimum free fall drop on the battery base surface.

3.3.1.5.1.2 Pivot Drop - Pivot drops of four inches using each of the battery base edges as a pivot.

3.3.1.5.2 Transportation and Handling - The packaged battery shall withstand the following transportation and handling shocks:

3.3.1.5.2.1 Handling - Free drops up to 21 inches depending on packaged battery gross weight, in accordance with Figure 8.

3.3.1.5.2.2 Shipping - The battery may experience shipping and handling shocks which result in acceleration peaks on the order of 100 g.

3.3.2 Operating - The following conditions, occurring separately or in combination, may be encountered by the battery in its installed condition. The battery shall meet performance requirements of 3.2, with the exception of 3.2.4.2 and 3.2.8, while being subjected to the environments specified herein.

3.3.2.1 Humidity - The battery shall withstand a relative humidity of 95 percent.

3.3.2.2 Altitude - The battery shall withstand pressures ranging from 15.0 psia to 0.008 inch of mercury (Hg) absolute.

3.3.2.3 Temperature - The battery shall withstand surrounding air temperature ranging from +60°F to +100°F.

3.3.2.4 Vibration - The battery shall withstand complex vibration values (including sinusoids and random noise) for a total of nine minutes in each axis as tabulated below:

Sinusoidal (one or more frequencies) 20-2000 Hz	Peak Power Spectral Density (averaged over 50 Hz band) 15-2000 Hz	Total rms over spectrum
10 g rms	0.6 g^2/Hz	33 g rms

3.3.2.5 Sustained Acceleration - The battery, starting 24 (+2, -0) seconds after start of activation, shall withstand accelerations to 13.5 ±0.5 g along the plus Z axis, applied as rapidly as test facilities permit, but not exceeding five seconds, for 180 seconds minimum. During the above accelerations, the battery shall also withstand 2g acceleration along its "X" and "Y" axis.

3.4 Reliability - The battery reliability requirement shall be 0.997 or greater probability of functioning as required in 3.2 with 90 percent confidence.

3.5 Physical Characteristics

3.5.1 Dimensions

3.5.1.1 Unactivated Battery - The volume, mounting dimensions, and brackets shall be in accordance with 7327690.

3.5.1.2 Activated Battery - The canister may expand 0.08 inch maximum, on any side, during the 226 seconds after start of activation. Following 226 seconds after activation, the battery may expand a maximum of 0.80 inch on any side (terminate requirement at 600 seconds).

3.5.2 Weight - The total weight of the battery including the wiring hardware (nuts and washers) shall not exceed 15 pounds. The shorting device shall not be included in total weight.

3.6 Identification and Marking - The battery shall have a suitable means of identification in accordance with Specification MIL-N-18307.

3.6.1 Identification - The battery shall be identified by a nameplate containing at least the following information:

Battery Power Supply	PP3249/DJW-15
Source Control No.	7327690-10
Mfg. Part No.	**
Serial No.	*
MFC	**
Fill Gas	100% helium @ 0 psig
NSN	6135-00-819-8074-AH
Government Contract or Order No.	*
Date of Manufacture	*
Battery Weight	*
Inspection Stamp	*

*Information to be filled in for each battery.
**Information to be supplied by Battery Manufacturer (MFC = Manufacturers Code No.).

3.6.2 Markings - All external terminals shall be clearly and permanently marked. A decal showing the internal battery wiring and external connections shall be placed on the exterior of the battery canister. A decal showing torquing limits shall be placed on the exterior of the battery canister and a red caution "See Torquing Decal" decal shall be placed near the terminals. A warning flag (approximately 3 x 22.5 inches) shall be permanently attached to the shorting device. The flag shall be of red material with the words: "CAUTION: Remove shorting device and do not reconnect while battery is installed in missile." A "Caution Electrolyte Vent Port" decal shall be placed on the face of the battery near the venting port.

3.7 Workmanship - The battery shall be fabricated and finished in such a manner that criteria of appearance, fit and adherence to specific tolerances shall be observed. Particular attention shall be given to the neatness and thoroughness of soldering, wiring, marking of parts and assemblies, plating, painting, riveting, machine screw assemblage, welding and brazing, and freedom of parts from burrs and sharp edges. All water used in the electrolyte solution and final wash on negative plates shall be deionized. The finished plates shall be dried and placed in a temperature and humidity controlled area for storage. After the construction of cells, the cells are also to be stored in a temperature and humidity controlled area prior to assembly into a cell block.

The finished cell block shall be vacuum dried, back-filled with a clean, dry, inert gas and sealed until assembly to the actuator. These operations shall be conducted in accordance with Air Force approved supplier specifications. Details of workmanship shall be subject to inspection and approval of the Air Force.

All fusion welds shall be done by a certified welder per specification MIL-W-8611, except 3.3.1.2 of MIL-W-8611. All resistance welding shall be certified per specification MIL-W-6858. All other welding shall meet the supplier's Air Force approval specifications.

3.8 Human Engineering - The battery shall be constructed so as to eliminate maintenance. The threaded terminals 1 and 2 (see 7327690), shall be size coded to eliminate the possibility of improper connection.

3.9 Safety - The construction of the battery shall be such that its use shall not create a fire hazard, hazardous current leakage, or explosion under any conditions of storage or operating conditions for not less than 226 seconds after activation when discharged to the load profile of Figure 4. A device shall be installed which shall short the squib terminals to the battery case to eliminate the possibility of accidental activation during transport, storage, or handling. The design of the shorting device shall be such that installation of the activation leads shall not be possible with the shorting device installed and installation of the shorting device shall not be possible with activation leads installed.

3.10 Storage Life - The battery with hermetic seal intact shall exhibit a minimum storage life of five years without need of maintenance and shall be capable of meeting all the requirements of this specification at any time during the five years.

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of Tests - The inspection and testing of the battery shall be classified as (a) Acceptance and (b) Preproduction. See 4.2 and 4.5 respectively.

4.2 Acceptance Tests - Acceptance tests shall consist of: Individual Tests and Sampling Tests as specified in 4.2.1 and 4.2.2 below. Acceptance test failure diagnosis shall be conducted as specified in 4.2.3.

4.2.1 Individual Tests

4.2.1.1 Battery - Each battery shall be subjected to the following tests:

(a)	Examination of Product	(Ref. 4.4.1)
(b)	Performance Tests (as specified)	(Ref. 4.4.2.4, 4.4.2.7, 4.4.2.8, and 4.4.2.10)
(c)	Dimensions and Weight Test	(Ref. 4.4.5)
(d)	Identification and Marking	(Ref. 4.4.6)
(e)	Workmanship	(Ref. 4.4.7)
(f)	Preservation, Packaging and Packing	(Ref. 4.4.11)

4.2.1.2 Cell Pack - Each cell pack shall be subjected to the resistance test of 4.4.2.9.1.

4.2.2 Sampling Tests - Sampling lot acceptance tests shall consist of Cell, Battery and Gas Generator (Squib) sampling tests as specified in 4.2.2.1, 4.2.2.2, and 4.2.2.3 below for continuous production runs. A production run shall be considered continuous if no part of the battery production process is changed or stopped for a period of more than 13 days. The production process shall be defined as starting with procurement of critical raw materials and acceptance of piece parts and as ending after installation of the battery into the canister.

The quantities of batteries specified below shall be subjected to the tests of 4.2.2.2.3 and cells shall be subjected to the tests of 4.2.2.1.3 when the following situations below occur.

Situation	Quantity (Minimum)
1st Production run on a new process	10 batteries
14 - 21 days stoppage - no process change	50 cell packs
22 - 45 days stoppage - no process change	100 cell packs
46 - 90 days stoppage - no design change	6 batteries
More than 90 day stoppage	6 batteries

When production is interrupted and resumed, batteries and/or cell packs shall be randomly selected from the first production lot in quantities shown above. The results of these tests shall be used to satisfy the lot acceptance sample test requirements of paragraphs 4.2.2.1.3 and 4.2.2.2.3 as appropriate. Any cell pack or battery not meeting the requirements of these tests shall be cause for rejection of the entire first lot.

If the cause of failure can be detected and proven and after corrective action is approved by the procuring agency and instituted, the supplier shall furnish another sample randomly selected from the subject lot. This sample shall be subjected to the same tests as the failed sample.

Acceptance of the remainder of the lot shall be based on the acceptable performance of the test samples. The total sample size shall equal or exceed the quantities shown above; however, if repeat tests are successful, the failures causing retest shall not be factored into the test results.

4.2.2.1 Cell Sampling Tests

4.2.2.1.1 Cell Pack Lot - A cell pack lot shall be made up of negative plates from one negative plate production run and positive plates from one positive plate production run. A cell pack lot shall consist of enough cell packs to form one battery lot including test cells (Ref. 4.2.2.2.1). A cell pack group shall consist of enough cell packs, from one cell pack lot, to form one battery plus four test cells.

4.2.2.1.2 Cell Pack Sample Size - Prior to installation of cell packs into assemblies, a sample of four cell packs shall be selected at random from each cell pack group fabricated for each battery. Positive identification shall be maintained between each cell pack sample and the serial number of the battery to which the cell pack sample corresponds.

4.2.2.1.3 Cell Pack Tests - The cell pack sample shall be tested to the conditions specified in 4.4.2.9.2.

4.2.2.1.4 Cell Pack Acceptance Criteria - The non-destructively tested portion of the cell pack group fabricated for a battery shall be considered acceptable for installation in that battery if the sample from that group met the requirements of 3.2.8 and all remaining cell packs met the requirements of 3.2.4.2. The remaining portion of the cell pack group shall be rejected if any member of the pack sample failed to meet the requirements of 3.2.8.

4.2.2.2 Battery Sampling Tests

4.2.2.2.1 Battery Lot - A lot is a quantity of batteries submitted for acceptance at one time, and manufactured or assembled in sequence without changes in design, materials, tooling, or processes. A battery production lot can consist of two to eleven batteries.

4.2.2.2.2 Battery Sample Size - A sample shall be drawn at random from each lot submitted for acceptance. From any one production lot the maximum number of deliverable batteries shall be ten. The minimum sample size shall be one battery from each normal production lot of eleven batteries.

4.2.2.2.3 Battery Test - From each production lot of eleven, the odd numbered battery samples shall be tested to the conditions specified in 4.4.3.2.4.3 and the even numbered samples shall be tested to the conditions specified in 4.4.3.2.4.4.

4.2.2.2.4 Battery Acceptance Criteria - The non-destructively tested portion of a lot of batteries shall be considered acceptable for shipment if they meet all of the requirements of 4.2.1. The entire lot shall be rejected if any battery in the sample failed to meet the requirements of 4.2.2.2.3 with the following exceptions.

4.2.2.2.4.1 Catastrophic Failure - When a sample battery fails the requirements of 3.2.1.1 and the cause of failure can be proven and the defect can be corrected and verified in future batteries, those defective parts not yet incorporated into a battery may be reworked. After appropriate approved (by procuring agency) corrective action has been instituted, the supplier shall furnish another sample, drawn at random from the subject lot and submitted to the same conditions as the failed unit. The acceptance of the subject lot shall be based on the acceptable performance of this replacement sample. If the repeat test is successful, the failure causing retest shall not be factored into the test results.

4.2.2.2.4.2 Test Equipment Malfunction - If a battery is unable to meet the requirements of 4.4.3.2.4.1 due to test equipment malfunction the data collected may be submitted to the customer for his evaluation. If the data indicates that the unit would have passed if the test equipment had functioned properly, the lot from which the test unit was selected may be adjudged to have satisfied the requirements of 4.4.3.2.4.1. If the data are adjudged to be insufficient or of marginal quality, then a second test will be required as defined in 4.2.2.2.4.1.

4.2.2.2.5 Continuance of Individual Tests - Individual tests may be continued pending the investigation of a sampling test failure.

4.2.2.3 Gas Generator Sampling Tests

4.2.2.3.1 Gas Generator Lot - A lot is a quantity of gas generators submitted for acceptance at one time and manufactured in sequence without changes in design, materials, tooling, or processes. An effort should be made to produce the generator lot with the same lot of igniters, sustainer powder, and solid propellant. If the generator lot contains more than one lot of the specified components, the lot samples selected for destructive test shall be selected in proportion to component lot presence within the generator lot.

4.2.2.3.2 Gas Generator Sample Size - GG samples shall be selected at random from each lot procured by the battery manufacturer in accordance with MIL-STD-105A, Level II, AQL 0.65.

4.2.2.3.3 Gas Generator Tests - All generators manufactured for end use and sample test shall be subjected to the following non-destructive inspection and tests:

1. Visual conformance to drawing and workmanship.
2. Radiographic inspection per MIL-STD-202, Method 209.

3. Insulation resistance per 3.2.2.2.1.
4. Bridgewire resistance per 3.2.2.2.2.

Destructive tests of lot sample units shall be conducted per 4.4.2.2 and verified for compliance with 3.2.2.2. Tests shall be performed on the sample as follows:

1.	No-Fire/Sure-Fire	100% of sample
2.	Peak Pressure	80% of sample
3.	Capacity	20% of sample

4.2.2.3.4 Gas Generator Acceptance Criteria - The non-destructively tested portions of the GG lot shall be considered acceptable for battery assembly if the sample from that lot met the requirements of 3.3.2 and the destructively tested GG passed the requirements of 4.2.2.2.3 with zero failures.

4.2.3 Failure Diagnosis - All cell packs, batteries, and gas generators which fail to meet the destructive test requirements of 4.2.2 shall be subjected to a postmortem and failure diagnosis beginning within 24 hours of failure. The procuring agency shall be notified of failure of any battery or major sub-assembly IAW contract. A report of the failure (i.e., cause, failure diagnosis and supplier's plan of action) shall be submitted to the procuring agency IAW contract.

4.3 Test Conditions

4.3.1 Atmospheric Conditions - Unless otherwise specified in 4.4, all tests required by this specification shall be made at atmospheric pressure at the test facility, a temperature of 75 ±15°F., and a relative humidity of 95 percent or less.

4.3.2 Ground Power Supply - The battery shall be activated in parallel with a ground power supply. The ground power supply shall supply 0 - 90 amperes (minimum), at +28 ±0.5 vdc with less than 0.5 v ripple, peak-to-peak, and less than 0.5 v regulation, full load to no load. The regulation shall be maintained with less than 0.5 millisecond response time. The ground power supply shall have the anode of an isolating diode connected directly to its positive output terminal to prevent the battery from discharging into it when activated. The loads and test battery shall be connected to the cathode of the isolating diode. The ground power supply shall be turned on at least five seconds prior to start of battery activation tests. The ground power supply shall be turned off at the "Ground Power Removal" time per Figures 4, 5, 6, and 7.

4.3.3 Battery Position - The battery shall be activated in the orientation defined in 3.2.1.3.

4.4 Test Methods

4.4.1 Examination of Product - Each battery shall be verified for compliance with the requirements of 3.1.

4.4.1.1 Intercell Connections - Two color photographs shall be taken during assembly of each battery to verify intercell connections in compliance with

the requirements of 3.1. The first photograph shall be taken of the cell group assembly after soldering of the intercell connectors, but before the presealing operation. The second photograph shall be taken of the cell block, activator, lid assembly after the lid potting operation but prior to the assembly into the battery canister. A suitable fixture shall be used that rigidly relates the camera and light source to the battery (minimizing perspective distortion) so that the photographs of all subassemblies shall be taken from the same angle and at the same distance. The subassembly identification card (traveller) shall be shown with the part number and serial number prominently displayed, so as to be legible in the color photographs. An appropriate combination of filter and light source shall be used which allows the optimum color rendition of the film as specified by film manufacturer.

4.4.2 Performance Tests

4.4.2.1 Battery Activation Tests - Battery activation tests shall be conducted in accordance with 3.2.1.

4.4.2.1.1 No-Fire Current Test - Apply an average current of 2.0 (+0.2, -0) amperes for a minimum of five minutes between terminals A & B (Ref. 7327690) and verify for compliance with the requirements of 3.2.1.3. Thereafter, proceed to the test of 4.4.2.1.2.

4.4.2.1.2 Sure-Fire Current Test - Apply a current of 9 (+0, -0.5) amperes maximum for a period of 20 milliseconds (+0, -5) between terminals A and B of SCD 7327690 and verify for compliance with the requirements of 3.2.1.2.

4.4.2.2 Gas Generator Tests

4.4.2.2.1 No-Fire - The generator shall be connected to a well-regulated dc power source and a current of 1.00 - 1.02 amperes shall be applied to the bridgewire for a minimum period of five minutes. The generator shall not function (fire) as a result of this application.

4.4.2.2.2 Sure-Fire - The generator shall be connected to a well regulated dc power source and a current of 3.40 - 3.50 amperes shall be applied to the bridgewire for a period of 15 - 20 milliseconds. The generator shall function (fire) as a result of this application.

4.4.2.2.3 Peak Pressure - The generator shall be installed in a closed, 135 ±1 CC bomb. Subsequent to sure-fire current application, the pressure in the bomb shall be monitored for a period of at least 2.5 seconds with electronic pressure monitoring equipment having an accuracy of ±2 percent. The generator shall develop a peak pressure within the bomb of 1100 ±400 psig within a two second maximum period from time of sure-fire current application.

4.4.2.2.4 Capacity - The generator shall be installed in a suitable, water filler chamber with an outlet orifice (0.50 - 0.75 inch inside diameter). Subsequent to sure-fire current application, the amount of water displaced by the gas produced from the generator shall be a minimum of 1200 cubic centimeters.

4.4.2.3 Battery Characteristics Test

4.4.2.3.1 Load Profile I - The battery shall be activated in accordance with the load and time profile of Figure 4 with the voltage verified for compliance with the requirements of 3.2.3.1 and the dimensions verified for compliance with 3.5.1.2.

4.4.2.3.2 Load Profile II - The battery shall be activated in accordance with the load and time profile of Figure 5 with the voltage verified for compliance with the requirements of 3.2.3.2 and the dimensions verified for compliance with 3.5.1.2.

4.4.2.3.3 Load Profile III - The battery shall be activated in accordance with the load and time profile of Figure 6 with the voltage verified for compliance with the requirements of 3.2.3.3 and the dimensions verified for compliance with 3.5.1.2.

4.4.2.3.4 Load Profile IV - The battery shall be activated in accordance with the load and time profile of Figure 7 with the voltage verified for compliance with the requirements of 3.2.3.4 and the dimensions verified for compliance with 3.5.1.2.

4.4.2.4 Insulation Resistance Test - The insulation resistance shall be measured and verified for compliance with the requirements of 3.2.4.1 and 3.2.4.2.

4.4.2.5 Current Leakage Test - Monitor the current leakage during battery operation (Ref. 4.4.2.3) and verify for compliance with the requirements of 3.2.5 for all sample batteries not exposed to test conditions which could increase the internal humidity of the battery. Test instrumentation shall be capable of measuring 3.0 (±3 percent) microamperes of leakage current between the negative terminal 1 and the canister (Ref. 7327690). and 1.0 A

4.4.2.6 Electrolyte Leakage Test - The battery shall be visually inspected during storage and operation tests (Ref. 4.4.2.3) to verify compliance with the requirements of 3.2.6.

4.4.2.7 Helium Leak Rate Test - The helium leak rate from the canister shall be measured using a Mass Spectrometer Leak Detector in conformance with MIL-STD-202D to verify compliance with the requirements of 3.2.7.

4.4.2.8 Dielectric Strength Test - Apply 500 ±25 vac (rms) at a frequency of 60 ±1 Hz for a minimum of one minute between each of the sets of points listed in 3.2.9 and verify for compliance with the requirements of 3.2.9.

4.4.2.9 Activating Circuit Resistance - The resistance of the circuit between terminals A and B shall be measured and verified for compliance with the requirements of 3.2.1.1. Limit test current to 20 milliamperes and total test time to five minutes.

4.4.2.10 Cell Pack Tests

4.4.2.10.1 Insulation Resistance - Apply 100 ±5 vdc for a minimum of 15 seconds to the cell pack terminals and verify for compliance with the resistance requirements of 3.2.4.2. Each cell pack shall be under compression equal to or exceeding the final assembly compression during resistance tests.

4.4.2.10.2 Performance Test - The cell pack samples selected in accordance with 4.2.2.1 and the allocated electrolyte shall be temperature soaked at +60°F maximum for a minimum time period of one hour. The cell packs shall then be activated in an identical manner and discharged within ten minutes after removal from the controlled temperature chamber to the load profile I (Figure 4). Voltage shall be monitored to verify compliance with the requirements of 3.2.8.

4.4.3 Environmental Tests

4.4.3.1 Non-Operating Environments - Accomplish the tests of 4.2.1.1 before and after exposure to each of the following environments.

4.4.3.1.1 Humidity/Temperature - Place the battery in a humidity/temperature chamber and increase the temperature to 115 ±2°F in accordance with 3.3.1.3. At the same time, increase the relative humidity to at least 95 percent and maintain these conditions a minimum of 100 hours in accordance with 3.3.1.1. After the 100 hours, lower the temperature to 80 (+4, -0)°F, and the humidity to ambient. Maintain these conditions for at least eight hours.

4.4.3.1.2 Temperature/Altitude - Place the battery in a temperature/altitude chamber and reduce the chamber pressure to a pressure corresponding to an altitude of at least 50,000 feet in accordance with 3.3.1.2. At the same time, reduce the temperature to -50 ±5°F and hold for a minimum of eight hours in accordance with 3.3.1.3. At the end of the eight-hour period, return the pressure to ambient, and raise the temperature to +60 ±2°F for at least eight hours.

4.4.3.1.3 Vibration - The battery shall be vibrated in turn in each of three mutually perpendicular directions under the following conditions as specified in 3.3.1.4.

Accelerations: 3.5 g rms between 5 and 50 Hz unless precluded by maximum double amplitude of 0.4 inch and 1.5 g rms between 50 and 300 Hz.

Frequencies Range: 5 to 300 Hz and 300 to 5 Hz.

Duration: Two sweeps at 1/2 octave per minute both upwards and downwards in frequency range (about 49 minutes total in each coordinate direction).

The vibration shall be applied and measured at the points of mounting the battery to the transportation case or fixture.

4.4.3.1.4 Shock

4.4.3.1.4.1 Free Fall - The unpackaged battery shall be subjected to two each, 1 (+1/8, -0) inch free fall drops of the battery, in the orientation of 3.2.1.3, onto a hard surface.

4.4.3.1.4.2 Pivot Drop - Mark the four sides of the battery base and place the battery on a hard surface in the orientation of 3.2.1.3. Using the first side as a pivot, tilt up the opposite side until the battery base forms an

angle of 45 degrees, but keeping the vertical projection of the battery base, whichever occurs first. Allow the battery to fall back freely to the hard surface in returning to its original position. Repeat this procedure using each side as a pivot in accordance with 3.3.1.5.1.2.

4.4.3.1.4.3 Free Drop - The packaged battery shall be subjected to two free drops on a hard surface from a height depending on packaged weight in accordance with Figure 8 and 5.2.2.3.

4.4.3.1.4.4 Machine - The packaged battery shall be subjected to two machine shocks as defined in Figure 9 through each of axes as defined in 7327690. An alternate method of applying the shock pulse with a drop test machine may be used. By this method, the shock pulse shall be a half sine wave characteristic with a peak of 72.5 ±7.5 g's and a period of 5 ±1 milliseconds.

4.4.3.2 Operating Environments - Accomplish the tests of 4.2.1.1 before exposure to each of the following environments.

4.4.3.2.1 Humidity/Temperature - Place the battery in a humidity/temperature chamber and raise the temperature to 100 (+0, -4)°F. At the same time, the relative humidity shall be raised to at least 95 percent and maintained for a minimum of eight hours in accordance with the requirements of 3.3.2.1 and 3.3.2.3.

4.4.3.2.2 Temperature/Altitude - Place the battery in a temperature/altitude chamber and raise the temperature to 115 ±2°F, in accordance with the requirements of 3.3.1.3, and maintain for a minimum of eight hours. At the end of this period the temperature shall be lowered to 80 (+4, -0)°F and maintained for a minimum of eight hours. At the end of the period, the battery shall be activated in accordance with 3.2.1 and subjected to the load profile as specified in 3.2.3.1. Twenty-four (+2, -0) seconds after activation, the pressure shall be gradually reduced from ambient to 0.008 (+0, -.001) inch of Hg in accordance with 3.3.2.2. This reduction in pressure shall take place over a period of 70 +0.10 seconds. The chamber shall be maintained at this pressure until the completion of the discharge of the battery. Verify that voltage output per 3.2.3.1 is acceptable during this test.

4.4.3.2.3 High Temperature - Batteries shall be subjected to the high temperature tests of 4.4.3.2.3.1 and 4.4.3.2.3.2.

4.4.3.2.3.1 Load Profile I - Each battery assigned to this test shall be temperature soaked at 100 (+0, -4)°F for a minimum of eight hours in accordance with 3.3.2.3. The battery shall then be subjected to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.1 Battery Characteristics Test, Load Profile I
d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.3.2 Load Profile II - Each battery assigned to this test shall be temperature soaked at 100 (+0, -4)°F for a minimum of eight hours in

accordance with 3.3.2.3. The battery shall then be subjected to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.2 Battery Characteristics Test, Load Profile II
d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.4 Low Temperature - Batteries shall be subjected to the low temperature tests of 4.4.3.2.4.1 and 4.4.3.2.4.2.

4.4.3.2.4.1 Load Profile I - Each battery assigned to this test shall be temperature soaked at 60 (+0, -4)°F for a minimum of eight hours in accordance with 3.3.2.3. The battery shall then be subject to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.1 Battery Characteristics Test, Load Profile I
d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.4.2 Load Profile II - Each battery assigned to this test shall be temperature soaked at 60 (+0, -4)°F for a minimum of eight hours in accordance with 3.3.2.3. The battery shall then be subjected to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.2 Battery Characteristics Test, Load Profile II
d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.4.3 Load Profile III - Each battery assigned to this test shall be temperature soaked at 60 (+0, -4)°F for a minimum of eight hours in accordance with 3.3.2.3. The battery shall then be subject to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.3 Battery Characteristics Test, Load Profile III
d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.4.4 Load Profile IV - Each battery assigned to this test shall be temperature soaked at 60 (+0, -4)°F for a minimum of eight hours in accordance with 3.3.2.3. The battery shall then be subject to the following tests within 30 minutes after removal from the temperature chamber:

a. 4.4.2.1.1 No-Fire Current Test
b. 4.4.2.1.2 Sure-Fire Current Test
c. 4.4.2.3.4 Battery Characteristics Test, Load Profile IV

d. 4.4.2.5 Current Leakage Test
e. 4.4.2.6 Electrolyte Leakage Test

4.4.3.2.5 Vibration - A total of six batteries are required for vibration testing. Two batteries are required for each test axis. Each test battery shall be activated in accordance with 3.2.3.1 and beginning 24 ±0.10 seconds after start of activation the battery shall be vibrated in the applicable axis. The batteries shall be vibrated in each of three coordinate directions (Ref. 7327690) and under the conditions of Table I in accordance with the requirements of 3.3.2.4. The sinusoidal and random vibrations shall be applied simultaneously and measured at the points of attachment of the battery to the vibration fixture. Performance parameters shall be measured during the vibration in accordance with 4.4.2.3.1. The batteries shall operate without failure or malfunction.

TABLE I
Operative Vibration Test Conditions

Sinusoidal One Sweep 20-2000 Hz	Gaussian Random 15-2000 Hz	Duration in Each Axis
10 g rms	0.6 g^2/Hz	9 minutes

NOTES:

1. The sinusoidal vibration shall be swept at a constant octave/minute sweep rate.

2. Limit vibration to 0.4 inch double amplitude.

3. Limit sinusoidal vibration to 6 g rms below 50 Hz unless precluded by the maximum amplitude of Note 2.

4. Stop test after vibrating first battery 4.5 minutes; continue testing with a new battery; the sinusoidal sweep shall begin at the frequency at which the previous portion of the test ceased.

5. Roll-off random vibration at 12 db/octave (on an acceleration basis) from 1000 to 2000 Hz.

6. Limit random vibration to 0.3 g^2/Hz below 50 Hz,and 0.1 g^2/Hz below 25 Hz.

7. Tolerance on power spectral density

   Below 500 Hz
   Narrow Band ($\leq$ 6 Hz) ±3 db

   Above 500 Hz
   Wide Band ($\leq$ 100 Hz) ±3 db
   Narrow Band ($\leq$ 6 Hz) ±10 db

4.4.3.2.6 Sustained Acceleration - The battery shall be subjected to a sustained acceleration in accordance with the requirements of 3.3.2.5 for a minimum of 180 seconds.

4.4.4 Reliability Test - The reliability requirements of 3.4 for all deliverable batteries shall be deemed fulfilled if (1) prior to their delivery to the Government the manufacturer of said batteries satisfactorily completes the preproduction tests with production samples of said batteries as set forth in 4.5, and (2) lot samples of said batteries satisfactorily complete the requirements of 4.2.

4.4.5 Dimensions and Weight Test - The battery shall be visually and physically examined to verify conformance with the physical characteristics and requirements of 3.5.1.1 and 3.5.2.

4.4.6 Identification and Marking - The battery shall be visually examined to verify conformance with Standard MIL-STD-130 and the requirements of 3.6.1 and 3.6.2.

4.4.7 Workmanship - The battery shall be verified to be in conformance with the requirements of 3.7.

4.4.8 Human Engineering - The battery shall be examined to verify compliance with the requirements of 3.8.

4.4.9 Safety - The battery shall be examined to verify compliance with the requirements of 3.9.

4.4.10 Storage Life - The storage life requirement of 3.10 shall be considered fulfilled for all deliverable batteries upon their complying with the acceptance test requirements of 4.2.

4.4.11 Preservation, Packaging and Packing - The battery shall be visually inspected to verify compliance with the requirements set forth in Section 5.

4.5 Preproduction Tests - Preproduction tests will include all tests described under 4.4. Preproduction testing shall be conducted only when, and to the extent, specified in the contract.

4.5.1 Preproduction Test Samples - The preproduction test samples shall consist of models representative of the production equipment. They shall be tested at a laboratory designated by the procuring activity, or when so stated in the contract, at the contractor's plant under the supervision of the procuring activity.

4.5.2 Preproduction Tests - Twenty batteries shall be subjected to preproduction tests as of 4.4.3.1 and 4.4.3.2 as specified in Table II.

4.5.3 Rejection and Retest - If a failure, malfunction or out-of-tolerance performance degradation prohibited by this specification occurs during preproduction testing, the test shall be discontinued, the trouble corrected and complete pertinent environmental procedure (such as vibration in three directions) shall be repeated until completed successfully. If the corrective

TABLE II. PREPRODUCTION TEST PLAN SCHEDULE - SE13G

DESCRIPTION OF TEST	BATTERY NUMBER																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NON-OPERATING TESTS																				
Temperature/altitude (4.4.3.1.2)	X																			
Humidity/temperature (4.4.3.1.1)		X																		
Vibration (4.4.3.1.3)				X																
Shock (4.4.3.1.4)			X																	
OPERATING TESTS																				
Temperature/altitude (4.4.3.2.2)								X	X											
Humidity (4.4.3.2.1)										X	X									
Vibration (X Axis) (4.4.3.2.5)												X			X					
Vibration (Y Axis) (4.4.3.2.5)													X			X				
Vibration (Z Axis) (4.4.3.2.5)														X			X			
Sustained acceleration (4.4.3.2.6)																		X	X	X
Temperature +80°F Profile I (4.4.3.2.3.1)		X						X		X								X		X
Temperature +60°F Profile I (4.4.3.2.4.1)	X		X									X		X		X				
Temperature +80°F Profile II (4.4.3.2.3.2)					X		X		X		X								X	
Temperature +60°F Profile II (4.4.3.2.4.2)				X		X							X		X		X			
Contingency*							X													

*This battery shall be used to replace any battery lost in testing or to investigate marginal conditions or failures in the tests shown above.

action substantially affects the significance of results of previously completed tests of the sequence, such tests shall also be repeated.

5 PREPARATION FOR DELIVERY - The Purchase Order shall identify the level of packaging.

5.1 Level A/B (Long Term Storage)

5.1.1 Unit Package

5.1.1.1 Terminals - The terminal area shall be suitably capped with an easily removable and replaceable wood or rigid plastic protective cover to prevent damage to the terminals during in-plant handling and during shipping.

5.1.1.1.1 External Wiring - All external wiring hardware shall be individually heat-sealed in bags (or between two sheets) of polyethylene. A full set of this hardware shall be placed in a cloth bag and tied to one of the mounting brackets for each deliverable battery. The shorting bar shall be securely fastened between terminals A and B (Ref. 7327690) but so as not to damage the gold plating and to be easily removed at the time of operational installation.

5.1.1.2 Primary Enclosure - The battery shall be enclosed in an antistatic (surface resistivity not in excess of 10^{12} ohms per square inch) polyethylene bag (6 mil minimum thickness), or other suitable Air Force approved material, containing desiccant (MIL-D-3464) and a humidity indicator (MS26507). The bag shall be heat-sealed.

5.1.1.3 Primary Container - The battery, enclosed in the bag, shall be inserted into a corrugated carton (PPP-B-636, Type CF, Class domestic). Internal blocking and bracing shall be used as required to protect the battery and bag from physical damage.

5.1.1.4 Unit Container - The corrugated carton shall be placed into a suitable inner metal container. Corrugated sheet dunnage shall be used within the metal container to prevent movement of the carton. The metal container shall be purged and filled with a dry, 100 percent, inert gas, and hermetically sealed.

5.1.1.5 Secondary Enclosure - The hermetically sealed secondary container shall be enclosed in a polyethylene bag (4 mil minimum thickness), or other suitable Air Force approved material, containing desiccant (MIL-D-3464) and a humidity indicator (MS26507). The humidity indicator shall be easily readable through the polyethylene bag on the end of the container.

NOTE: The hermetically sealed container shall be suitably cushioned to prevent rupture to the polyethylene bag.

5.1.2 Exterior Packing

5.1.2.1 Exterior Container - The unit package shall be inserted into a metal shipping drum conforming to MIL-D-6054 with the humidity indicator, as specified in paragraph 5.1.1.5, visible without removing the unit package from the shipping drum.

5.1.2.2 Cushioning - The unit package shall be cushioned within the shipping drum. The dunnage, vermiculite or equivalent, shall be capable of protecting the battery and bag from physical damage when the package is tested in accordance with paragraph 5.1.2.3.

5.1.2.3 Shock Resistance - The shipping drum, with the internal dunnage, shall be capable of preventing damage to the battery when the container is dropped (with the center of gravity aligned with the point of impact) onto a concrete or steel surface from a height depending on packaged weight in accordance with 3.3.1.5.2.1. Two drops will be made. One drop with drum axis horizontal, and one with drum axis vertical.

5.2 Level C/B (Immediate Use)

5.2.1 Unit Package

5.2.1.1 Terminals - The terminal area shall be suitably capped with an easily removable and replaceable wood or rigid plastic protective cover to prevent damage to the terminals during in-plant handling and during shipping.

5.2.1.1.1 External Wiring - All external wiring hardware shall be individually heat-sealed in bags (or between two sheets) of polyethylene. A full set of this hardware shall be placed in a cloth bag and tied to one of the mounting brackets for each deliverable battery. The shorting bar shall be securely fastened between terminals A and B (Ref. 7327690), but so as not to damage the gold plating and to be easily removed at the time of operational installation.

5.2.1.2 Primary Enclosure - The battery shall be enclosed in an antistatic (surface resistivity not in excess of 10^{12} ohms per square inch) polyethylene bag (6 mil minimum thickness) or other suitable Air Force approved material. The bag shall be heat-sealed.

5.2.1.3 Unit Container - The battery, enclosed in the bag, shall be inserted into a corrugated carton (PPP-B-636, Type CF, Class domestic). Internal blocking and bracking shall be used as required to protect the battery and bag from physical damage.

5.2.2 Exterior Packing

5.2.2.1 Exterior Container - The unit package shall be inserted into a metal drum conforming to MIL-D-6054.

5.2.2.2 Cushioning - The unit package shall be cushioned within the metal drum. The dunnage, vermiculite or equivalent, shall be capable of protecting the battery and bag from physical damage when the package is tested in accordance with paragraph 5.1.2.3.

5.2.2.3 Shock Resistance - The shipping drum, with the internal dunnage, shall be capable of preventing damage to the battery when the container is dropped (with the center of gravity aligned with the point of impact) onto a concrete or steel surface from a height depending on packaged weight in accordance with 3.3.1.5.2.1. Two drops will be made, one with drum axis horizontal, the other with drum axis vertical.

5.3 Marking

5.3.1 Unit Container - Each unit package (reference 5.1.1.4 and 5.2.1.3) shall be durably and legibly marked per MIL-STD-129 and shall include the following as a minimum:

Battery Power Supply	PP-3249/DJW-15
Manufacturer's Model No.	*
Manufacturer's Serial No.	*
Source Control No.	7327690-10
Date of Manufacture	*

Shipping and Storage Temperature Limits: -50°F to +115°F. CAUTION - Do not store in unsheltered condition with direct sun exposure.

5.3.2 Exterior Container - Each exterior container (reference 5.1.2.1 and 5.2.2.1) shall be durably and legibly marked per MIL-STD-129 and will include the following as a minimum:

Battery Power Supply	PP-3249/DJW-15
Source Control No.	7327690-10
Manufacturer's Name	*
Manufacturer's Serial No.	*
Manufacturer's Model No.	*
Purchase Order No.	*
Date of Manufacture	*
Net Weight	*
Gross Weight	*

Caustic Warning Label/I.C.C. Regulations.

Shipping and Storage Temperature Limits: -50°F to +115°F. CAUTION - Do not store in unsheltered condition with direct sun exposure.

U.S.

*Information to be filled in for each battery.

6. NOTES

6.1 Intended Use - The Battery Power Supply is intended to supply 28 vdc power to equipment in the MINUTEMAN missile.

6.2 Figure A Number - This specification conforms to the technical requirements of Figure A 6210.

6.3 Ordering Data - Procurement documents should specify the following:

a. Title, number, and date of this specification.

b. Part defined by Source Control Drawing 7327690.

c. Stock number and serialization requirements as applicable.

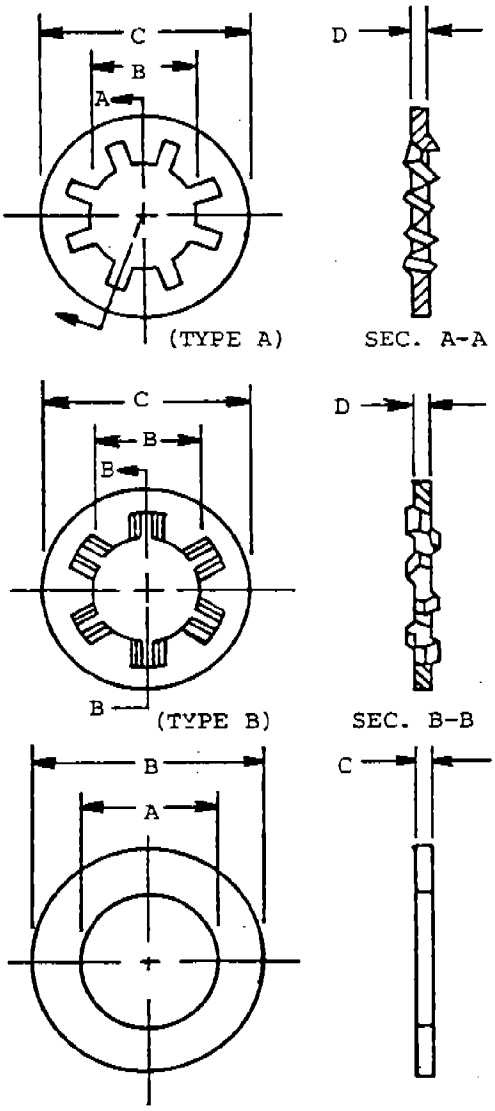
d. Level of preservation, packaging and packing to be used (as described in Section 5 of this specification).

e. Preproduction Testing

DELETED

f. Acceptance tests are required as indicated in 4.2 of this specification. Final acceptance data shall be recorded on the form of the type shown in Figure 10. If the unit is destructively tested as a lot sample, the final acceptance data shall be accompanied by a voltage/current versus time graph depicting battery performance. The lot sample test data shall be adequately identified, indicating test conditions and key performance results.

g. Number of lot sample batteries to be destructively tested. If not specified, the minimum of one unit per lot will be tested (see paragraph 4.2.2.2).



INTERNAL TOOTH LOCKWASHER

TERMINAL	B (DIA)	C (DIA)	D	MATERIAL
1	0.384 / 0.398	0.692 / 0.670	0.040 / 0.032	AISI 410 STAINLESS STEEL
2	0.320 / 0.332	0.610 / 0.594	0.034 / 0.028	
A&B	0.195 / 0.204	0.381 / 0.365	0.025 / 0.020	

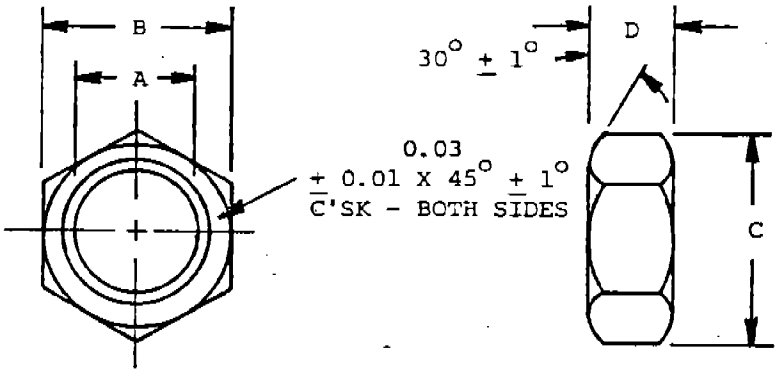
NUMBER OF TEETH SHOWN IS APPROXIMATE

PLAINWASHER SIZE

TERMINAL	A (DIA)	B (DIA)	C (±0.010)	MATERIAL
1	0.403 / 0.407	0.720 / 0.700	0.047	COPPER
2	0.324 / 0.328	0.700 / 0.680	0.032	
A&B	0.191 / 0.195	0.448 / 0.468	0.032	

ALL DIMENSIONS ARE INCHES

FIGURE 1 - BATTERY TERMINAL WASHERS



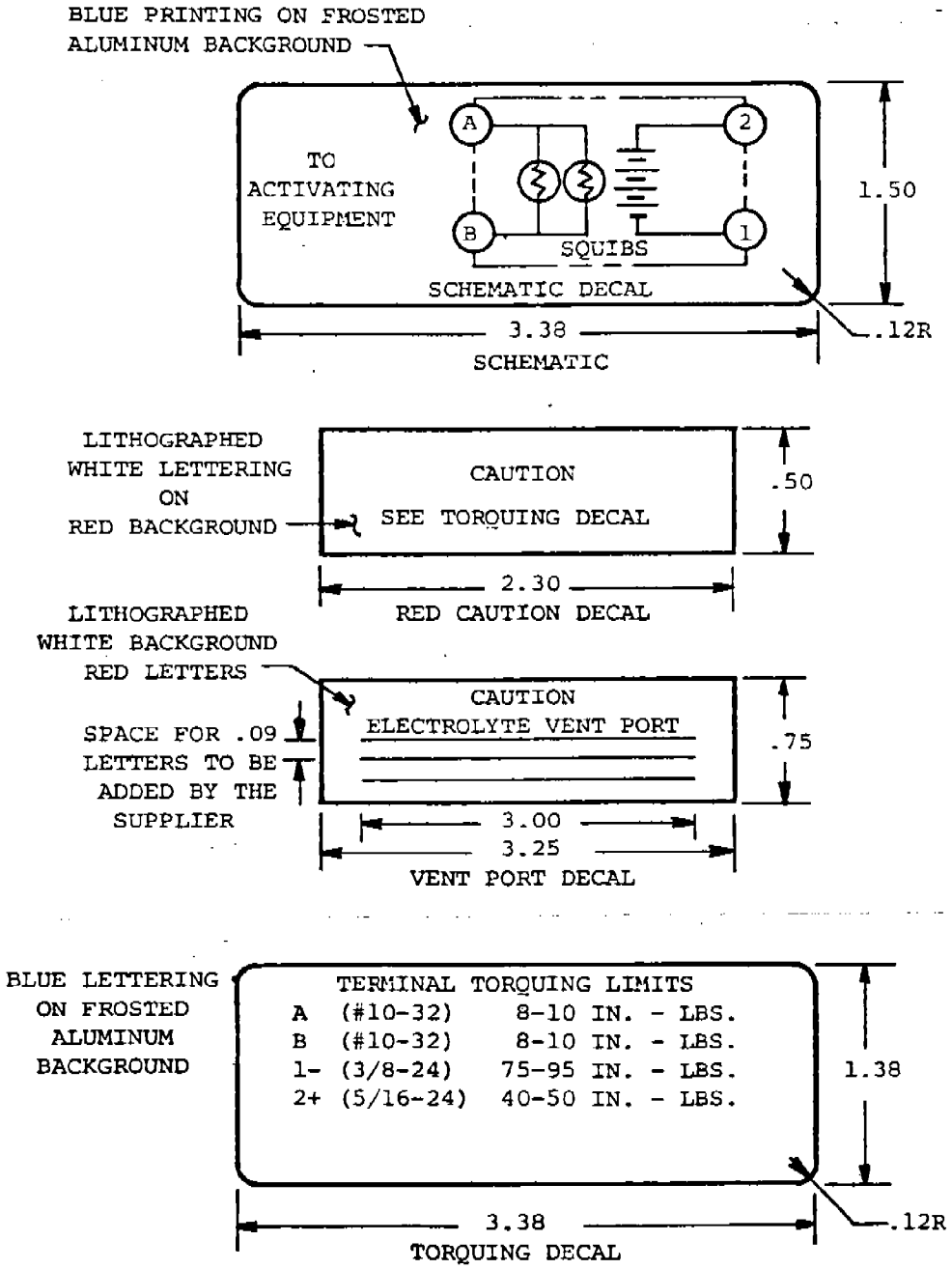
TERMINAL	HEX NUT SIZE	A (DIA)	B	C	D	MATERIAL
1	3/8-24 UNF -2B PD $\frac{0.3479}{0.3528}$	$\frac{0.330}{0.340}$	$\frac{0.562}{0.551}$	$\frac{0.650}{0.628}$	$\frac{0.227}{0.210}$	COPPER
2	5/16-24 UNF -2B PD $\frac{0.2854}{0.2902}$	$\frac{0.267}{0.277}$	$\frac{0.500}{0.489}$	$\frac{0.577}{0.557}$	$\frac{0.195}{0.180}$	COPPER
A&B	10-32 UNF -2B PD $\frac{0.1697}{0.1736}$	$\frac{0.156}{0.164}$	$\frac{0.375}{0.362}$	$\frac{0.433}{0.413}$	$\frac{0.130}{0.117}$	COPPER

1. SURFACE FINISH ON ALL MACHINED SURFACES SHALL NOT EXCEED 80 MICROINCHES.

2. ALL MACHINED CORNERS TO HAVE 0.01 MAX BREAK.

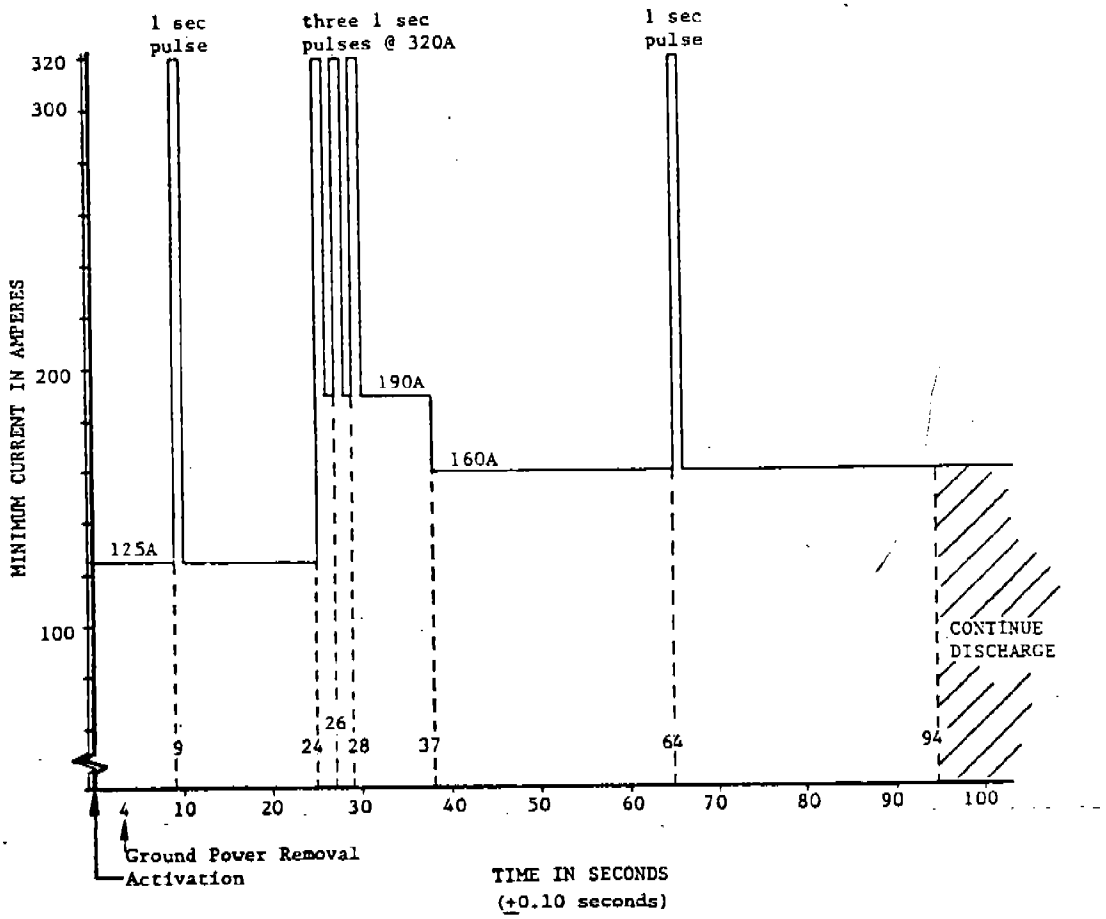
3. ALL DIMENSIONS ARE INCHES.

FIGURE 2 - BATTERY TERMINAL STUD HARDWARE



ALL DIMENSIONS ARE INCHES

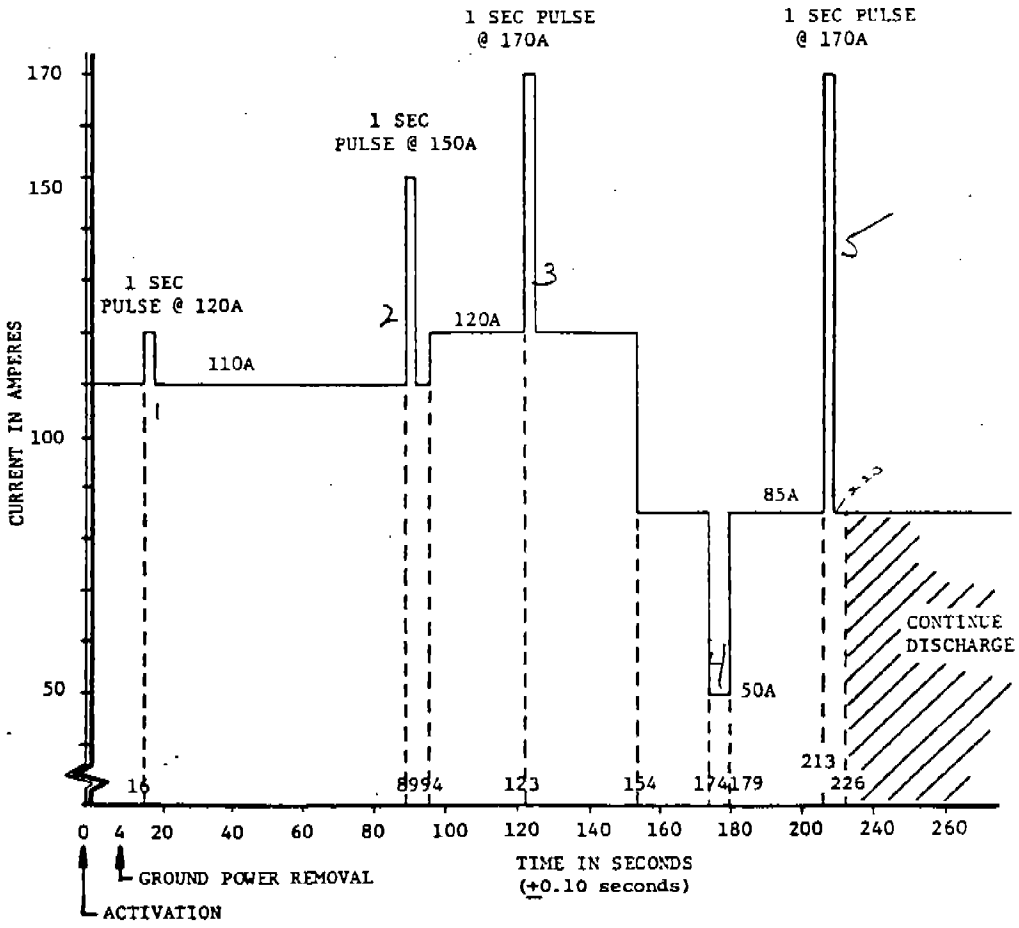
FIGURE 3 - DECALS



NOTES:
1. Pulses are one second (+0.5, -0).
2. Battery test current shall be as shown (+10%, -0), and cell test current shall be as shown (+20%, -0).
3. Ground power shares load from activation to 4 seconds.
4. Current requirements do not apply up to 4 seconds after activation.

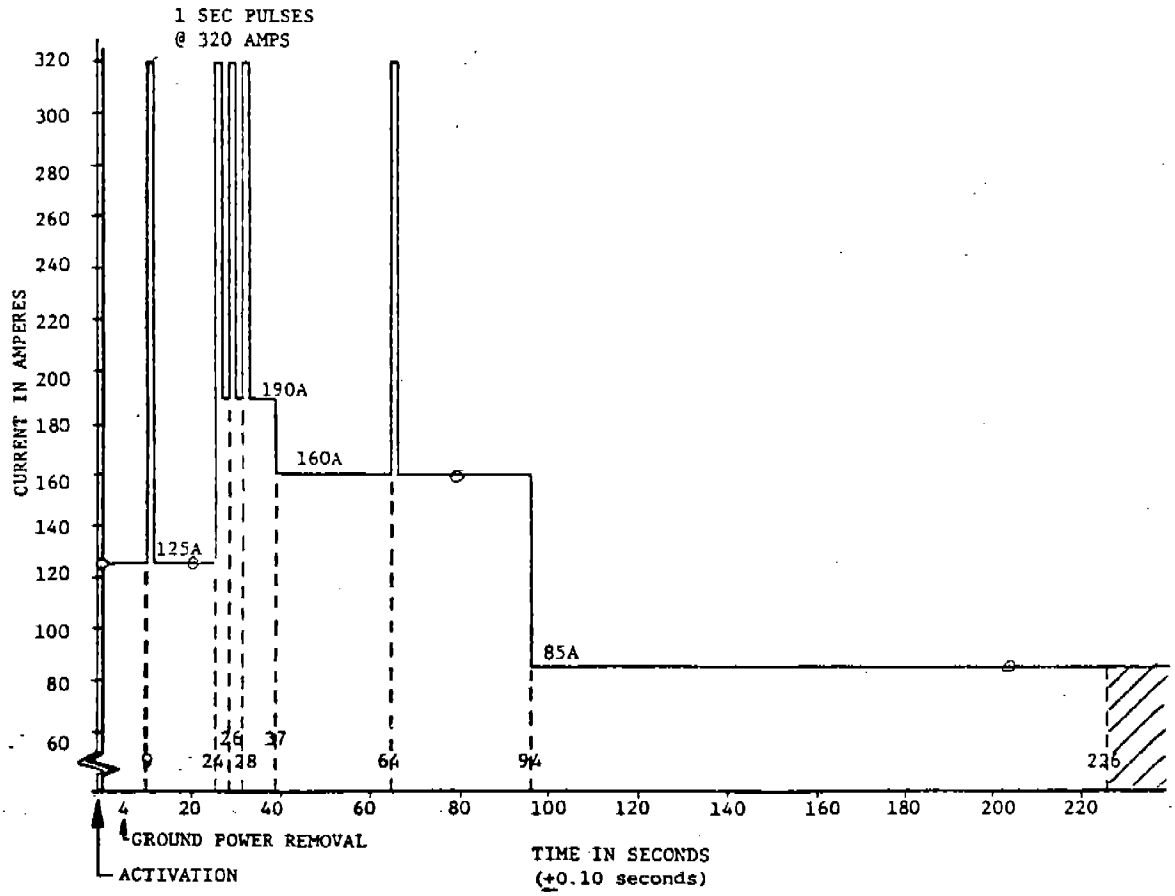
SE-139

FIGURE 4 - SE13G MINUTEMAN I, II, AND III STAGE I NCU LOAD PROFILE I (ORIGINAL PROFILE)



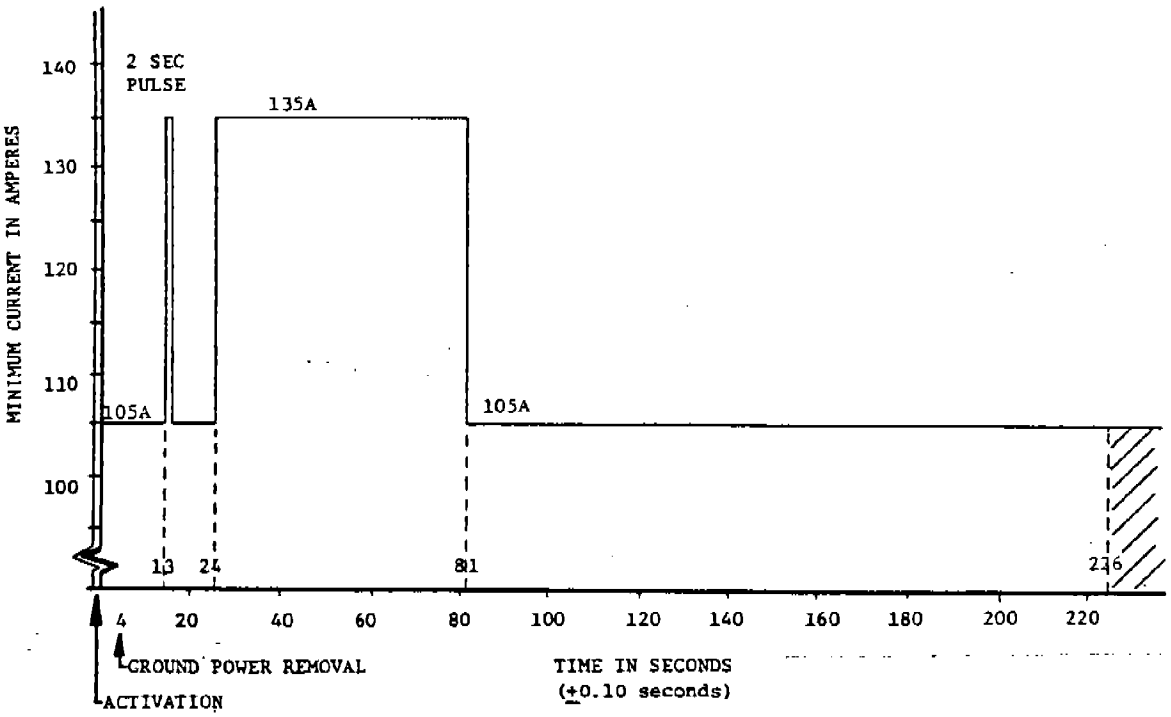
NOTES:
1. Low voltage limit at one second pulses is 27 volts.
2. Pulses are one second (+0.5, -0).
3. Battery test current shall be as shown (+10%, -0), and cell test current shall be as shown (+20%, -0).
4. Ground power shares load from activation to 4 seconds.
5. Current requirements do not apply up to 4 seconds after activation.

FIGURE 5 - SE13G MINUTEMAN II MGS LOAD PROFILE II



NOTES:
1. Pulses are one second (+0.5, -0).
2. Battery test current shall be as shown (+10%, -0), and cell test current shall be as shown (+20%, -0).
3. Ground power shares load from activation to 4 seconds.
4. Current requirements do not apply up to 4 seconds after activation.

FIGURE 6 - SE13G COMBINED MMI, II, AND III STAGE I NCU AND MGS PROFILE III



NOTES:
1. Two second pulse (+0.5, -0).
2. Battery test current shall be as shown (+10%, -0), and cell test current shall be as shown (+20%, -0).
3. Ground power shares load from activation to 4 seconds.
4. Current requirements do not apply up to 4 seconds after activation.

Time to 2800 26.0 24.0

FIGURE 7 - SE13G NEW (REALISTIC) MMI, II, AND III
STAGE I NCU PROFILE IV

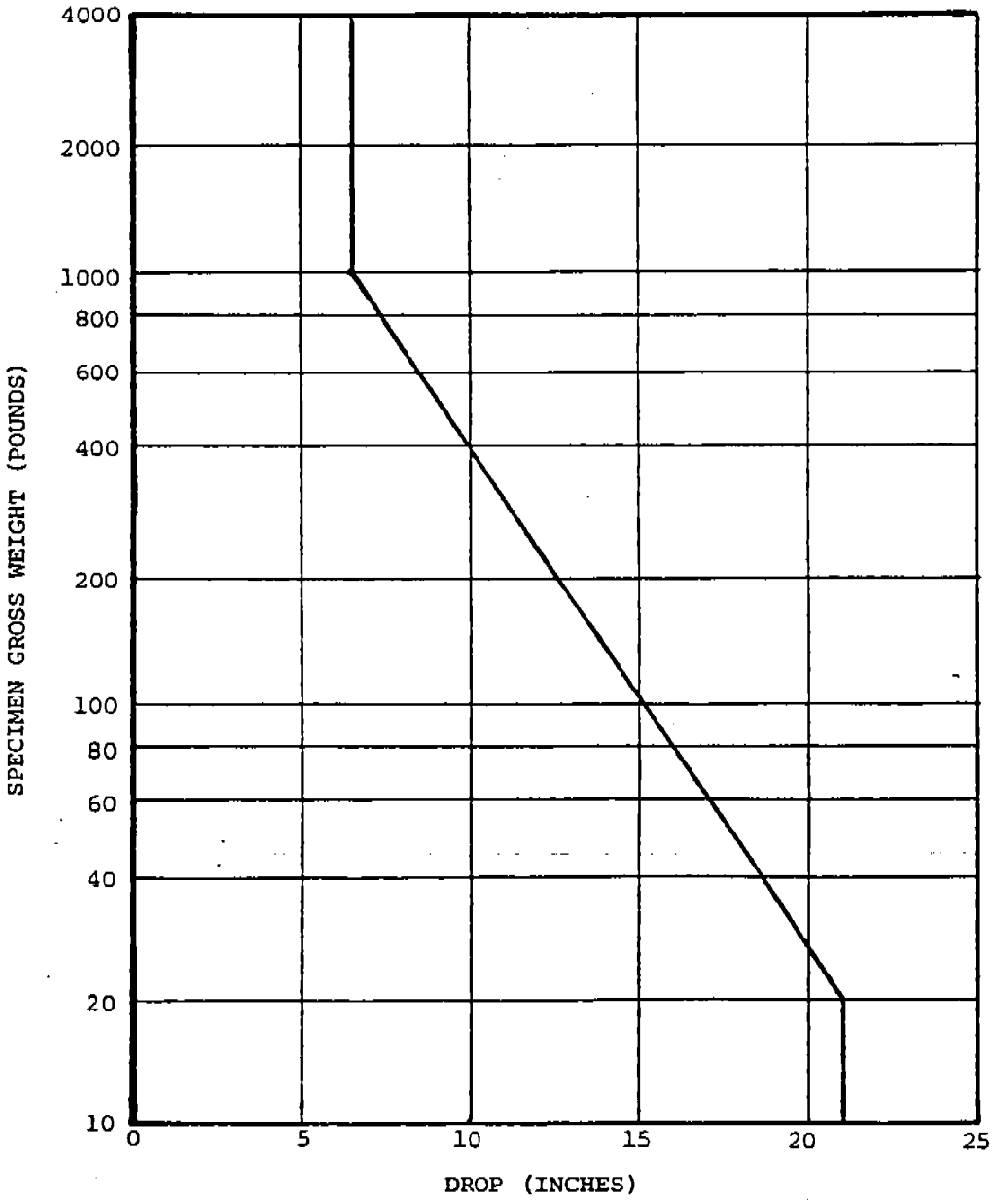
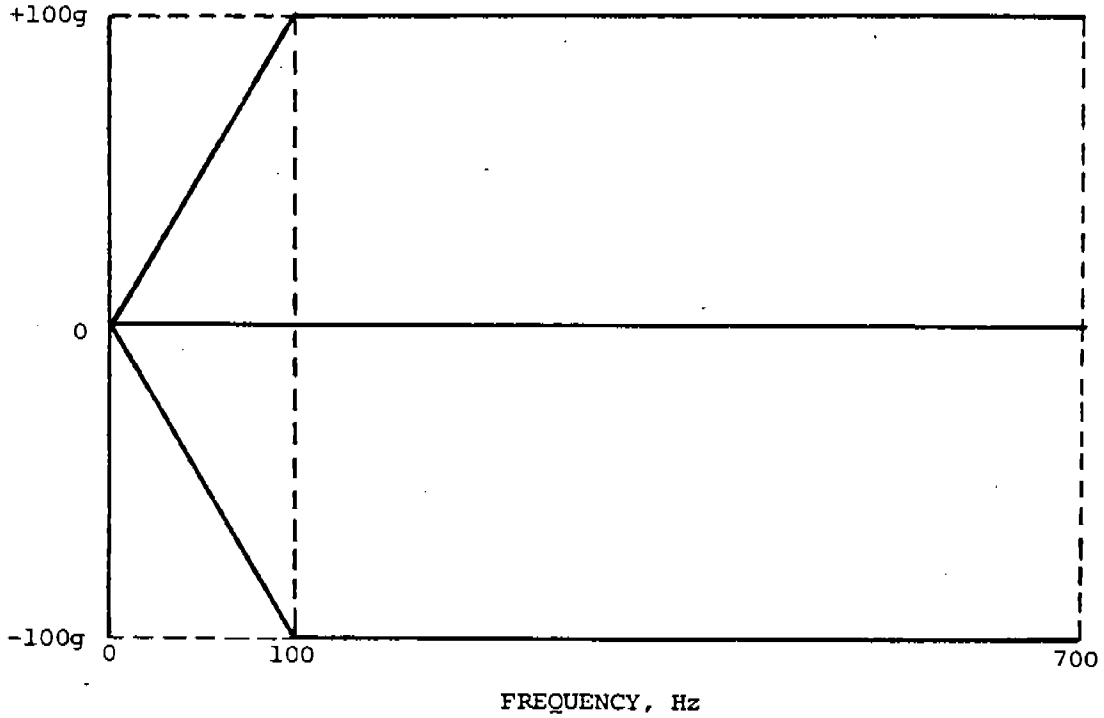


FIGURE 8 - DROP OF PACKAGED EQUIPMENT



PRIMARY SPECTRUM TOLERANCES

A) 0-100 Hz Frequency Range: ±10g or -30% to +50%.

B) 100-200 Hz Frequency Range: -10% to +50%.

C) 200-700 Hz Frequency Range: -30% to +50%.

NOTE: Spectrum may be applied continuously as shown, or in halves with respect to: sign, low and high frequencies, or both.

FIGURE 9 - SHOCK SPECTRA, NONOPERATING

SOLICITATION NR: F42..0-80-R-1186

DATA LIST

DL 1990012
Sheet 1 of 2

SE-13G BATTERY
INDENTURED PARTS LIST

BATTERY MODEL: 1990012
Control Dwg: 7327690-10 6 Oct 76
00-ALC Spec ME-PD-73-11
Figure A 6210

VOLTS: 28

OVERALL DEMINSIONS: Maximum Length 11.18
Maximum Width 5.28
Maximum Height 6.060

Indenture								
1	2	3	4	5	6	7	8	Part Nomenclature
x								1990012 General Assembly
	x							1956509 Battery Case Assembly
	x							1956505 Lid Assembly
		x						1956564 Lid
		x						1956500 Glass Seal
			x					Inner Ring
			x					Glass
			x					Outer Adapter Ring
		x						1956514 Terminal Stud
			x					1870919 Terminal Stud (Unplated)
		x						1956515 Terminal Stud
			x					1870920 Terminal Stud (Unplated)
		x						1956501 Glass Seal Terminal Assy (2 required)
			x					Terminal Stud (Plated)
			x					Glass Seal
			x					Adapter Ring
		x						1956677 Solder Ring (2 required)
		x						1956678 Solder Ring (as required)
		x						1956679 Solder Ring (as required)
	x							1956659 Trap and Safety Plug Assembly
		x						1969567 Safety Plug Assembly
			x					1969558 Safety Plug
			x					1956512 Diaphragm
		x						1956736 Trap and Tube Assy
			x					1956665 Fitting
			x					1956667 Tube
			x					1956658 Trap Assy
				x				1956654 Trap End Strip
				x				1956653 Trap Baffle
				x				1956652 Trap End Plate
				x				1956660 Trap End Plate
				x				1956656 Trap Plate
	x							1956538 Reservoir Assy
		x						1956539 Plug
		x						1956540 Tube
		x						1956541 Coupling

Indenture 1	2	3	4	5	6	7	8	Part Nomenclature
		x						1956543 Cylinder Assy
			x					1956547 Piston
			x					1956546 Cylinder Tube and End Assy
				x				1956548 Cylinder Tube
				x				1956549 Gas Generator Recpt. & Cy. End Assy.
					x			1956680 Cylinder End Assy. Blank
						x		1953582 Cylinder End.
						x		1953584 Gas Gen. Recept. Assy. (2 required)
							x	1953535 Retaining Ring
							x	1953536 Diaphragm
							x	1953581 Gas Generator Receptacle
			x					1956544 Cylinder End and Hub Assy
				x				1953966 Filler Tube
				x				1956545 Cylinder End
				x				1953521 Spherical Diaphragm
				x				1953524 Hub - Top Plate
				x				1953529 Hub Assy
					x			1953523 Screen
					x			1953527 Hub
		x						1956516 Cell Block
			x					1956562 Fibre Glass Wrap
			x					1956563 Fibre Glass Wrap
			x					1956517 Cell Group Assy
				x				1956518 Connector (19 required)
				x				1956522 Lead and Clip Assy
					x			1956523 Clip
					x			1956524 Lead
				x				1956519 Lead and Clip Assy
					x			1956520 Clip
					x			1956521 Lead
				x				1954018 Plate and Block Assy
					x			1954014 Plate
					x			1953980 Block (2 required)
				x				1956537 Cell Assy "X" (9 required)
					x			1956534 Cell Envelope
					x			1956526 Cell Envelope
					x			1956531 Separator (9 required)
					x			1956532 Separator (9 required)
					x			1956528 Positive Plate (9 required)
						x		1956647 Positive Plate Material & Grid Assy
							x	1956642 Pos. Plate Material
							x	1956645 Strip - Pos. Grid & Tab Assy
							x	1956643 Strip - Positive Grid
							x	1956529 Tab (2 required)
					x			1956530 Negative Plate (10 required)
						x		1956504 Strip - Negative Grid & Tab Assy
							x	1956529 Tab (6 required)
							x	1956502 Strip - Negative Grid
				x				1956533 Cell Assy "Y" (10 required)
					x			1956534 Cell Envelope
					x			1956526 Cell Envelope
					x			1956531 Separator (9 required)
					x			1956532 Separator (9 required)
					x			1956535 Positive Plate (9 required)

Indenture 1	2	3	4	5	6	7	8	Part Nomenclature
					x			1956646 Positive Plate Material & Grid Assy
						x		1956642 Positive Plate Material
						x		1956644 Strip - Positive Grid & Tab Assy
							x	1956643 Strip - Positive Grid
							x	1956529 Tab (2 required)
				x				1956536 Negative Plate (10 required)
					x			1956503 Strip - Negative Grid & Tab Assy
						x		1956529 Tab (6 required)
						x		1956502 Strip - Negative Grid
			x					1956525 Cell Assembly "Z"
				x				1956527 Cell Envelope
				x				1956526 Cell Envelope
				x				1956531 Separator (9 required)
				x				1956532 Separator (9 required)
				x				1956528 Positive Plate (9 required)
					x			1956647 Positive Plate Material & Grid Assy
						x		1956642 Positive Plate Material
						x		1956645 Strip Positive Grid & Tab Assy
							x	1956643 Strip - Positive Grid
							x	1956529 Tab (2 required)
				x				1956530 Negative Plate (10 required)
					x			1956504 Strip - Negative Grid & Tab Assy.
						x		1956529 Tab (6 required)
						x		1956502 Strip - Negative Grid
	x							1947249 O-Ring
	x							1953677 Caution Decal
	x							1953749 O-Ring (2 required)
	x							1956539 Plug
	x							1956550 Gas Generator (2 required)
	x							1956552 Torquing Decal
	x							1956553 Schematic Decal
	x							1956554 Insulator
	x							800897 Shield and Flag Assembly
		x						800640 Shorting Shield Assy (2 required)
			x					800641 Shield - Shorting
			x					1943694 Spring
		x						800900 Rivet (2 required)
			x					1952741 Rivet
		x						800898 Flag Assy
			x					800899 Flag - Caution
			x					806529 Eyelet (2 required)
	x							1956556 Sleeve (2 required)
	x							1956557 Sleeve
	x							1956634 Screw (4 required)
	x							1956635 Insulator
	x							1956661 Hub and Filler Tube
	x							1956662 Coupling Insulator
	x							1956663 Vent Port Decal
	x							1956664 Foaming Plug
	x							1956666 Fitting
	x							1875672 Nameplate
	x							1964029 Nameplate
	x							1956669 Nameplate
	x							1956686 Lockwasher (4 required)

Indenture 1	2	3	4	5	6	7	8	Part Nomenclature
	x							1956690 Battery Hardware Kit
		x						1947241 Nut (2 required)
			x					1870754 Nut Unplated
		x						1947243 Nut
			x					1870756 Nut Unplated
		x						1947244 Nut
			x					1870757 Nut Unplated
		x						1947245 Washer
		x						1947246 Washer
		x						1947247 Washer (2 required)
		x						1956558 Lockwasher
		x						1956559 Lockwasher
		x						1956560 Lockwasher (2 required)
		x						1956707 Bag - Nylon
		x						1956723 Terminal Hardware Container